Werfen Group | Instrumentation Laboratory

K112995

MAY - 3 2012

510(k) Summary

This summary of 510(k) safety and effectiveness is being submitted in accordance with the requirements of SMDA 1990 and 21 CFR 807.92.

Applicant Contact Information:

Applicant:	Instrumentation Laboratory Co.
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Preparation Date:	April 25, 2012

Proprietary Name:

GEM® Premier 4000 with iQM® (Intelligent Quality Management)

GEM® CVP 1 and 2 (Calibration Valuation Product) *with* CO-Ox

GEM® CVP 3 and 4 (Calibration Valuation Product) Hematocrit

GEM® CVP 5 (Calibration Valuation Product) tBili

Regulatory Information:

- GEM Premier 4000 with iQM (Intelligent Quality Management)

Description	CFR Section	Device Class	Product Code
Blood gases and blood pH	862.1120	Class II	CHL
Sodium test system	862.1665	Class II	JGS
Potassium test system	862.1600	Class II	CEM
Calcium test system	862.1145	Class II	JFP
Chloride test system	862.1170	Class II	CGZ
Glucose test system	862.1345	Class II	CGA
Lactic acid test system	862.1450	Class I	KHP
Automated hematocrit instrument	864.5600	Class II	GKF
Carboxyhemoglobin assay	864.7425	Class II	GHS
Automated hemoglobin system	864.5620	Class II	GKR
Whole blood hemoglobin assays	864.7500	Class II	GLY
Bilirubin (Total or Direct) Test System	862.1110	Class II	CIG
(Total and Unbound) in the Neonate Test System	862.1113	Class I, Reserved	MQM

Regulatory Information (Cont.):

- GEM CVP 1 and 2 (Calibration Valuation Product) *with* CO-Ox
- GEM CVP 5 (Calibration Valuation Product) tBili

Description	CFR Section	Device Class	Product Code
Quality Control Material	862.1660	Class I	JJY

- GEM CVP 3 and 4 (Calibration Valuation Product) Hematocrit

Description	CFR Section	Device Class	Product Code
Hematocrit Control	864.8625	Class II	GLK

Predicate Device:

GEM Premier 4000 with iQM Original K061974; Update K093623

Description of Device Modification:

The potassium (K+) sensor membrane on the GEM Premier 4000 is being modified to lower the valinomycin concentration, along with a proportional decrease in the amount of counterion. This modification is being made to bring the K+ performance on the GEM Premier 4000 back to the original labeled claims as cleared under K061974 (no change to K+ claims under K093623).

- There are no changes to the following with this submission:
  - No expansion or change in indications for use /intended use
  - No change to performance claims, except to introduce sodium citrate as an interferent
  - No change to software
  - No change to instrument or cartridge hardware beyond the K+ sensor modifications
  - No change to the fluidic design
  - No change to sensor fundamental technology, including for the K+ sensor
  - No change to cartridge bag solutions or other measuring sensors
  - No change to labeling of the cartridge

Indications for Use (No Change from K093623):

The GEM Premier 4000 is a portable critical care system for use by health care professionals to rapidly analyze whole blood samples at the point of health care delivery in a clinical setting and in a central laboratory. The instrument provides quantitative measurements of pH, pCO_2, pO_2, sodium, potassium, chloride, ionized calcium, glucose, lactate, hematocrit, total bilirubin and CO-Oximetry (tHb, O_2Hb, COHb, MetHb, HHb) parameters. Total bilirubin can also be quantitated from heparinized plasma samples when analyzed in the tBili/CO-Ox mode. These parameters, along with derived parameters, aid in the diagnosis of a patient's acid/base status, electrolyte and metabolite balance and oxygen delivery capacity. Total bilirubin measurements are used in the diagnosis and management of biliary tract obstructions, liver disease and various hemolytic diseases and disorders involving the metabolism of bilirubin. In neonates, the level of total bilirubin is used to aid in assessing the risk of kernicterus.

Intelligent Quality Management (iQM) is used as the quality control and assessment system for the GEM Premier 4000 system. iQM is an active quality process control program designed to provide continuous monitoring of the analytical process with real-time, automatic error detection, automatic correction of the system and automatic documentation of all corrective actions, replacing the use of traditional external quality controls. Facilities should follow local, state and federal regulatory guidelines to ensure that a total quality management system is followed.

As part of this program, GEM CVP (Calibration Valuation Product) *with* CO-Ox, GEM CVP tBili and GEM CVP Hematocrit are external solutions intended to complete the calibration process and final accuracy assessment of the iQM cartridge calibration following warm-up. The reported values for GEM CVP (two levels for pH, blood gases, electrolytes, metabolites, total bilirubin, CO-Oximetry and hematocrit) must meet IL's specifications before the iQM cartridge can be used for patient sample measurements. Once the cartridge calibration is verified, the internal iQM program monitors the status of the system during the cartridge use life.

Comparison to Predicate Device:

Following are the similarities and differences between the current and modified K+ sensor membrane on the GEM Premier 4000:

- Similarities:
  - Same Indications for Use / Intended use
  - Same Test Environment
  - Same Operating Principle (Potentiometric Measurement)
  - Same Membrane Geometry
  - Same Membrane Components
  - Same Performance Characteristics, except to introduce sodium citrate as an interferent
- Differences limited to membrane formulation:
  - Lowered valinomycin concentration
  - Proportional decrease in the amount of counterion

Standards Referenced (if applicable):

- CLSI EP5-A2, Evaluation of Precision Performance of Clinical Chemistry Devices
- CLSI EP6-A, Evaluation of the Linearity of Quantitative Measurement Procedures: A Statistical Approach
- CLSI EP7-A2, Interference Testing in Clinical Chemistry
- CLSI EP9-A2, Method Comparison and Bias Estimation Using Patient samples
- CLSI EP17-A, Protocols for Determination of Limits of Detection and Limits of Quantitation
- CLSI EP-25-A, Evaluation of Stability of In Vitro Diagnostic Reagents
- CLSI C29-A2, Standardization of Sodium and Potassium Ion Selective Electrode Systems to the Flame Photometric Reference Method

Performance Characteristics Summary:

A series of studies were conducted that evaluated the performance of the GEM Premier 4000 system with the modified K+ sensor, including:

- Precision
- Linearity
- Interferences
- Method Comparison
- Field Site Testing

Whole Blood Precision

A precision study was conducted to evaluate the performance of the GEM Premier 4000 with the modified K+ sensor using whole blood. Each whole blood sample level was assayed twice per day in eight replicates for five days on two GEM Premier 4000 analyzers using the three sample modes: syringe, full capillary and micro capillary.

The results are presented in Tables 1-3 below.

Table 1: Whole Blood Precision Summary – Syringe Mode

Level	K^+ Mean (mmol/L)	N	Within Run SD	Within Run %CV	Total Imprecision SD	Total Imprecision %CV
Level 1	2.90	160	0.04	1.51%	0.04	1.51%
Level 2	3.88	160	0.05	1.32%	0.05	1.32%
Level 3	7.41	160	0.06	0.86%	0.06	0.86%

Table 2: Whole Blood Precision Summary – Full Capillary Mode

Level	K^+ Mean (mmol/L)	N	Within Run SD	Within Run %CV	Total Imprecision SD	Total Imprecision %CV
Level 1	3.06	160	0.11	3.55%	0.11	3.55%
Level 2	4.06	160	0.11	2.71%	0.11	2.71%
Level 3	7.44	160	0.12	1.58%	0.16	2.16%

Table 3: Whole Blood Precision Summary – Micro Capillary Mode

Level	K^+ Mean (mmol/L)	N	Within Run SD	Within Run %CV	Total Imprecision SD	Total Imprecision %CV
Level 1	3.34	160	0.11	3.31%	0.11	3.31%
Level 2	4.25	158*	0.11	2.66%	0.11	2.66%
Level 3	7.83	160	0.10	1.27%	0.10	1.27%

* One sample duplicate pair was discarded due to a pre-analytical issue.

Conclusion: All K+ results for whole blood precision were within specification.

Performance Characteristics Summary (Cont.):

Linearity

A linearity study was performed to evaluate the performance of the GEM Premier 4000 with the modified K+ sensor. Whole blood samples were manipulated through spiking and diluting to 7 different K+ concentrations spanning the claimed reportable range of 0.2 to 19 mmol/L. Flame atomic emission photometry (flame photometry), the preferred method to standardize direct ion-selective electrode analyzers for determination of K+, acted as the reference method in testing. Each concentration was tested in duplicate on the reference Flame Photometer and in triplicate on 3 different GEM Premier 4000 analyzers using the 3 sample modes: syringe, full capillary and micro capillary.

Graphs of the observed values (for each of the three GEM Premier 4000 instruments) versus the expected values (flame photometry) are provided below for the three sample modes: syringe (Figure 1), full capillary (Figure 2) and micro capillary (Figure 3).

Figure 1: GEM Premier 4000 in Syringe Mode (3 Instruments)

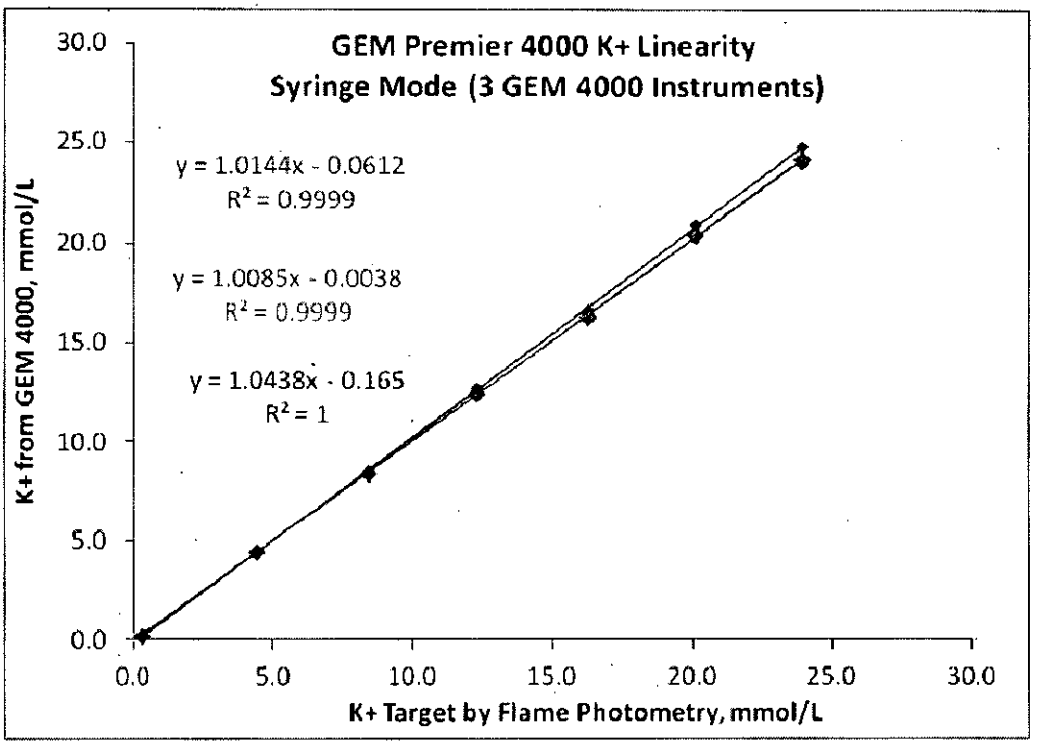


Figure 2: GEM Premier 4000 in Capillary Mode (3 Instruments)

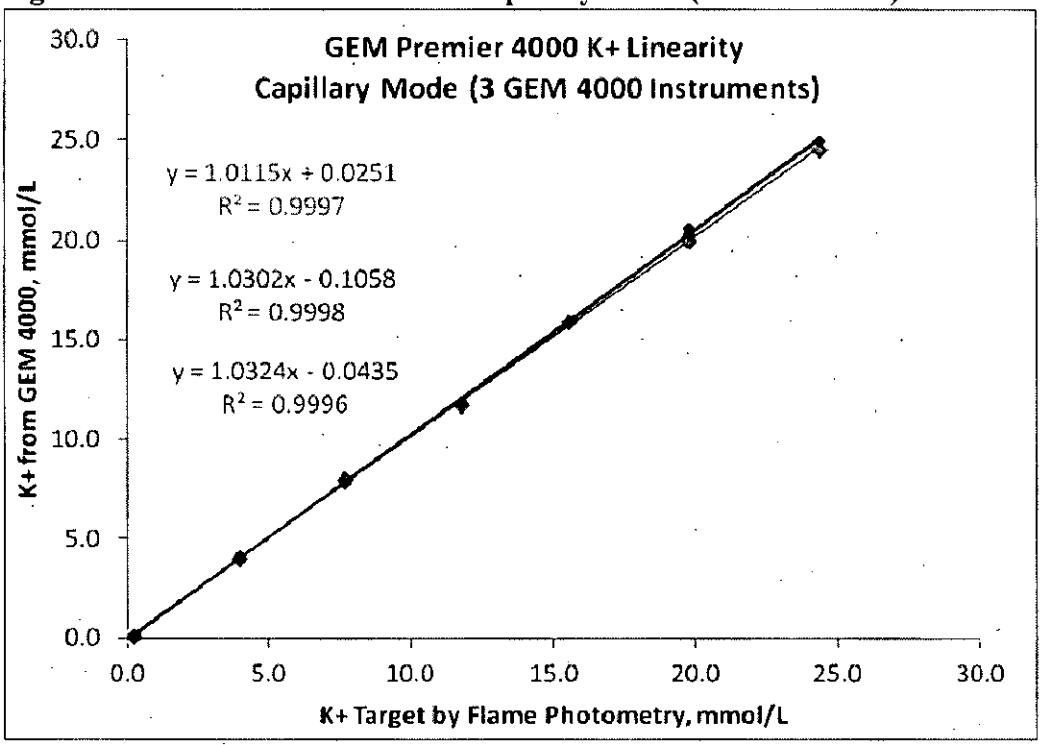
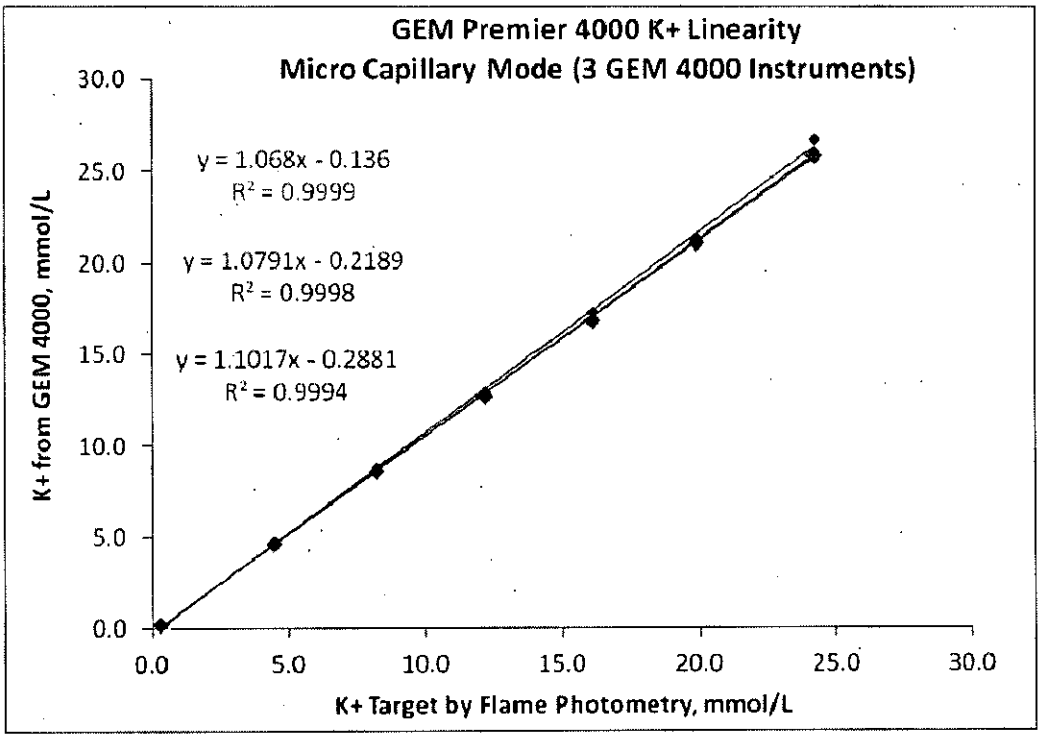


Figure 3: GEM Premier 4000 in Micro Capillary Mode (3 Instruments)



Conclusion: The linearity results support the current claimed reportable range of 0.2 to 19.0 mmol/L for the modified K^+ sensor on the GEM Premier 4000, using all sampling modes (syringe, full capillary and micro capillary).

Interferences

Interference testing was performed on the substances listed below using the GEM Premier 4000 with the modified K+ sensor. These substances represent endogenous substances, substances found among common abnormalities (e.g., lipemia), common prescription and over-the-counter drugs, sample additives such as anticoagulants and preservatives, abnormal biochemical metabolites, and medications often prescribed for critically ill patients.

Conclusion: Only citrate at concentrations at ≥ 7.3 mmol/L showed a clinically significant interference effect on the modified K+ sensor. Based on the results, the following limitation is being added to the labeling: "Blood collection tubes containing sodium citrate as an additive will produce a clinically significant change in potassium and should be avoided."

Method Comparison

An internal method comparison study was performed to compare the GEM Premier 4000 with the modified K+ sensor vs. GEM Premier 3000. All three sample modes were tested.

The summary results for each sample mode are presented in Table 5 below.

Table 5:

	N	Range of Samples	Slope (95% CI)	Intercept (95% CI)	R^2
Syringe	220	0.2 to 20.1 mmol/L	0.978 (0.972 to 0.984)	0.143 (0.112 to 0.174)	0.998
Full Capillary	220	0.2 to 19.5 mmol/L	0.980 (0.973 to 0.987)	0.169 (0.135 to 0.204)	0.997
Micro Capillary	220	0.2 to 20.6 mmol/L	0.987 (0.980 to 0.995)	0.276 (0.236 to 0.317)	0.997

Conclusion: The above results support that across the reportable range, the K+ performance on the GEM Premier 4000 with the modified K+ sensor is comparable to the GEM Premier 3000 for all sample modes (syringe, full capillary and micro capillary).

Field Site Testing

External field testing was performed to compare the GEM Premier 3000/3500 vs. GEM Premier 4000 with the modified K+ sensor in the clinical setting. All three sample modes were tested at three field sites.

The pooled summary results for each sample mode are presented in Table 6 below.

Table 6:

	N	Range of Samples	Slope (95% CI)	Intercept (95% CI)	R^2
Syringe	454	2.0 to 7.5 mmol/L	1.050 (1.040 to 1.061)	-0.106 (-0.147 to -0.064)	0.989
Full Capillary	304	2.3 to 5.6 mmol/L	1.018 (0.993 to 1.043)	-0.001 (-0.100 to 0.099)	0.957
Micro Capillary	304	2.3 to 5.6 mmol/L	0.996 (0.974 to 1.018)	0.218 (0.130 to 0.307)	0.963

Conclusion: The above results support that in the clinical setting, the K+ performance on the GEM Premier 4000 with the modified K+ sensor is comparable to the GEM Premier 3000/3500 for all sample modes (syringe, full capillary and micro capillary).

Final Conclusion:

Analysis of the validation and verification test results support that the GEM Premier 4000 with the modified K+ sensor membrane is safe, effective, and substantially equivalent to the predicate device.

DEPARTMENT OF HEALTH & HUMAN SERVICES

Food and Drug Administration

10903 New Hampshire Avenue
Silver Spring, MD 20993

Instrumentation Laboratory Co.
c/o Carol Marble
180 Hartwell Rd
Bedford, MA 01730

MAY - 3 2012

Re: k112995
Trade Name: GEM Premier 4000 with iQM (Intelligent Quality Management), GEM CVP 1 and 2 (Calibration Valuation Product) with CO-Ox, GEM CVP 3 and 4 (Calibration Valuation Product) Hematocrit, GEM CVP 5 (Calibration Valuation Product) tBili
Regulation Number: 21 CFR §862.1600
Regulation Name: Potassium test system
Regulatory Class: Class II
Product Codes: CEM, CHL, CGZ, CGA, CIG, GKR, GKF, GHS, GLK, GLY, JGS, JFP, JJY, KHP, MQM
Dated: March 29, 2012
Received: March 30, 2012

Dear Ms. Marble:

We have reviewed your Section 510(k) premarket notification of intent to market the device referenced above and have determined the device is substantially equivalent (for the indications for use stated in the enclosure) to legally marketed predicate devices marketed in interstate commerce prior to May 28, 1976, the enactment date of the Medical Device Amendments, or to devices that have been reclassified in accordance with the provisions of the Federal Food, Drug, and Cosmetic Act (Act) that do not require approval of a premarket approval application (PMA). You may, therefore, market the device, subject to the general controls provisions of the Act. The general controls provisions of the Act include requirements for annual registration, listing of devices, good manufacturing practice, labeling, and prohibitions against misbranding and adulteration.

If your device is classified (see above) into either class II (Special Controls) or class III (PMA), it may be subject to such additional controls. Existing major regulations affecting your device can be found in Title 21, Code of Federal Regulations (CFR), Parts 800 to 895. In addition, FDA may publish further announcements concerning your device in the Federal Register.

Please be advised that FDA's issuance of a substantial equivalence determination does not mean that FDA has made a determination that your device complies with other requirements of the Act or any Federal statutes and regulations administered by other Federal agencies. You must comply with all the Act's requirements, including, but not limited to: registration and listing (21 CFR Part 807); labeling (21 CFR Parts 801 and 809); medical device reporting (reporting of medical device-related adverse events) (21 CFR 803); and good manufacturing practice requirements as set forth in the quality systems (QS) regulation (21 CFR Part 820).

If you desire specific advice for your device on our labeling regulation (21 CFR Part 801), please contact the Office of In Vitro Diagnostic Device Evaluation and Safety at (301) 796-5450. Also, please note the regulation entitled, "Misbranding by reference to premarket notification" (21 CFR Part 807.97). For questions regarding postmarket surveillance, please contact CDRH's Office of Surveillance and Biometric's (OSB's) Division of Postmarket Surveillance at (301) 796-5760. For questions regarding the reporting of adverse events under the MDR regulation (21 CFR Part 803), please go to http://www.fda.gov/MedicalDevices/Safety/ReportaProblem/default.htm for the CDRH's Office of Surveillance and Biometrics/Division of Postmarket Surveillance...

You may obtain other general information on your responsibilities under the Act from the Division of Small Manufacturers, International and Consumer Assistance at its toll-free number (800) 638-2041 or (301) 796-5680 or at its Internet address http://www.fda.gov/MedicalDevices/ResourcesforYou/Industry/default.htm

Sincerely yours,

Courtney H. Lias, Ph.D.
Director
Division of Chemistry and Toxicology Devices
Office of *In Vitro* Diagnostic Device
Evaluation and Safety
Center for Devices and Radiological Health

Enclosure

Indications for Use Statement

510(k) Number (if known): K112995

Device Names: GEM® Premier 4000 with iQM® (Intelligent Quality Management)
GEM® CVP 1 and 2 (Calibration Valuation Product) *with* CO-Ox
GEM® CVP 3 and 4 (Calibration Valuation Product) Hematocrit
GEM® CVP 5 (Calibration Valuation Product) tBili

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Prescription Use √ (Part 21 CFR 801 Subpart D) AND/OR Over-The-Counter Use _____ (21 CFR 801 Subpart C)

(PLEASE DO NOT WRITE BELOW THIS LINE - CONTINUE ON ANOTHER PAGE IF NEEDED)

Concurrence of CDRH, Office of In Vitro Diagnostic Devices (OIVD)

Division Sign-Off
Office of In Vitro Diagnostic Device
Evaluation and Safety

510(k) K112995